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A guide is presented for planning or re-planning facilities and equipment for teaching vocational agriculture. This publication shows the relationship of facilities and equipment to current educational needs in agriculture and to the instructional programs of the other departments in a school. Emphasis is given to selecting the basic equipment, tools, supplies and teaching aids for agricultural mechanics in vocational agriculture. (FS)

A Guide For Planning

BUILDINGS, FACILITIES, *and* EQUIPMENT

for

VOCATIONAL EDUCATION IN AGRICULTURE

STATE DEPARTMENT OF PUBLIC INSTRUCTION
Raleigh, North Carolina June 1962

PREFACE

Methods of producing, processing, and marketing agricultural products are becoming more technical and specialized. Programs of Vocational Agriculture must be adjusted accordingly. Great instructional emphasis must be given in Vocational Agriculture to promoting understandings of principles and concepts underlying applied agricultural science and to developing the skills and abilities needed in modern agriculture.

Surveys of programs of Vocational Agriculture indicate that teaching facilities and equipment need to be improved in many schools, particularly for teaching agricultural mechanics. In some schools, simple woodworking exercises have comprised the total agricultural mechanics effort. This is inadequate in modern agriculture. Consequently, this publication was developed for use by local school officials in planning or in re-planning facilities and equipment for teaching Vocational Agriculture.

This publication shows the relationships of facilities and equipment to current educational needs in agriculture and to the instructional programs of the other departments in a school. Emphasis is on planning agricultural mechanics facilities.

This publication should be used as a guide by school administrators, boards of education, architects, and teachers of Vocational Agriculture. In addition, planners should call on consultants in the Division of Vocational Education and the Division of School Planning for assistance in developing plans for new facilities and in re-planning existing facilities.

Responsibility for preparation of the manuscript was assumed by Vaden B. Hairr, District Supervisor of Vocational Agriculture.

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I. INTRODUCTION

A. IMPORTANCE OF AGRICULTURAL MECHANICS IN VOCATIONAL AGRICULTURE

During the early development of this country, about 85 per cent of the people had to work the soil to produce the necessary food and fiber for their livelihood and for the other 15 per cent of the population. Today the consumption of farm products is much higher per capita, but less than 13 per cent of the population is required to produce the necesary food and fiber to meet this increased consumption. Why this abundance in production? Primarily it results from farm mechanization and other improved agriculutral technologies.

During recent years, agricultural mechanics has become of increasing importance to farmers. Much more progress has been made in farm mechanization during the past three decades than was made during the previous 250 years. This unprecedented expansion of mechanization has greatly reduced the amount of labor necessary for most farm enterprises. Also, it has greatly increased the farmer's capital investment in equipment.

Forty years ago the average farm worker had approximately 5 horsepower at his command compared to 50 horsepower today. This is one indication of the trend in farm mechanization. In 1954 the farmers of North Carolina had 136,985 tractors. By 1959 this number had increased to 150,737, a rise of 21 per cent. In 1954 the corn pickers in North Carolina numbered 6,774 compared to 10,087 in 1959, a 49 per cent increase in number. While mechanical horsepower has increased, animal power has drastically declined. The number of horses and mules in North Carolina dropped from 236,800 in 1954 to 145,101 in 1959—a reduction of 38 per cent.

The transition from animal power to mechanical power has changed requirements for farm buildings in lay-out and materials. Modern farm machinery requires replanning storage facilities and adding farm repair shops with power equipment.

The development and extension of rural electrical service places this source of power at the disposal of most farmers. Many uses of electrical power have developed in the home and on the farm. A working knowledge of electrical equipment is required of the modern day farmer.

In addition to better farm power, advances in soil and water resources management are greatly increasing farm productivity. Problems in drainage, erosion, and irrigation are being confronted constantly. Solutions to these problems have helped to develop many highly productive areas that otherwise would have been of very little value to agriculture and to the economy of the nation.

Because of rapid progress in the mechanization of agriculture, much emphasis should be given to teaching agricultural mechanics in vocational agriculture, both in the high school and adult instructional programs. Instruction in vocational agriculture must be geared to opportunities in farm mechanization. This may be accomplished through curriculum replanning and through facilities and equipment demanded by modern agricultural methods.

The emphasis of this publication is on the need for and selection of facilities and equipment for teaching agricultural mechanics in vocational agriculture. A beginning for this must include a serious consideration of objectives for teaching agricultural mechanics.

B. OBJECTIVES OF AGRICULTURAL MECHANICS IN VOCATIONAL AGRICULTURE

The following educational objectives are suggested for teaching agricultural mechanics in vocational agriculture and for determining the needs for facilities and equipment:

(1) To develop a general understanding of and an appreciation for the physical and mechanical aspects of farming and of other agricultural occupations and the importance of mechanics to agriculture as a whole.

(2) To develop an understanding of the underlying principles and concepts of agricultural mechanics processes and to deal with problems which involve the applications of these principles and concepts.

(3) To develop the abilities necesary to perform the important operations or processes involving the use of tools, machinery and mechanical equipment.

(4) To develop the ability to make wise decisions concerning mechanical activities to be performed.

The suggestions and recommendations contained in this publication concerning facilities, equipment, and teaching aids are in accordance with these four objectives.

C. BASIC INSTRUCTIONAL UNITS IN AGRICULTURAL MECHANICS

Leaders in Vocational Agriculture and Agricultural Engineering have identified four instructional units which should form the basis for what is to be taught in agricultural mechanics. These four units are:

1. Farm Engines and Machinery

This unit is designed to develop an understanding of the principles of power and machinery necessary for the economical operation of a modern farm. Instruction and supervised learning experiences help to dedevelop the necessary abilities for proper management, maintenance, and operation of farm engines and machinery. This unit may include the following sub-units: (a) ignition systems, (b) lubrication, (c) power transmission, (d) cooling systems, (e) lighting systems, (f) principles of a 4-cycle engine, (g) disk tools, (h) cutting and mowing machinery, and others.

2. Rural Electrification

Instruction in this unit provides understanding of principles and development of abilities required for planning, managing and maintaining the complex electrical systems on a modern farm. Sub-units of instruction may include (a) planning farmstead wiring systems, (b) servicing electrical equipment, (c) selecting electrical equipment, and others.

3. Soil and Water Management

Instruction in soil and water management deals primarily with the principles and mechanical methods for conservation of soil and water, application of water to the soil by mechanical means, and maintenance or improvement of soil fertility for production purposes. This unit of instruction may include sub-units such as (a) terracing, (b) drainage, and (c) irrigation.

4. Farm Buildings and Conveniences

Buildings for storage of present-day farm machinery, for livestock production, for curing and processing farm products, and for storage of farm products, require basic understanding of the principles and mastery of abilities needed for effectively planning, constructing and maintaining modern farm buildings and facilities.

Instruction in planning, constructing, and maintaining farm buildings and their fixtures may include such sub-units as (a) organizing and planning a farmstead, (b) planning farm buildings to meet future needs, (c) drawing and interpreting building plans, (d) preparing bills of construction materials, (e) replanning farmsteads, and (f) planning and constructing waste disposal and sanitation systems.

The nature of modern agriculture requires the inclusion of all four units in the instructional program. The extent that each unit described is included should be determined by the interests and needs of the individuals enrolled. Adoption of the four units will guide curriculum replanning toward tomorrow's agricultural needs. Modern agriculture requires an understanding of the application of scientific principles and concepts to agricultural problems. Curriculum replanning may be accomplished by developing "blocks" of teaching time within each instructional unit so that concentrated attention may be given to principles and concepts which undergird agricultural work. The unit approach to teaching agricultural mechanics encourages better planning and provides more efficient utilization of facilities and equipment.

The sections which follow deal with the plant, the facilities, and the equipment which appear to be needed in teaching Vocational Agriculture.

II. PLANNING THE PHYSICAL PLANT AND BASIC FACILITIES

A. LOCATION AND RELATIONSHIP TO OTHER AREAS OF THE SCHOOL PLANT

The program of vocational education in agriculture is an integral part of the total educational program of a school. Therefore, much thought and careful study should be given to a convenient location of the facilities within the instructional area of the total school plant. In planning, consideration should be given to the types of programs that may be offered in the future and to future educational needs of the individual students.

The teaching laboratory (shop) should be located and designed to avoid disturbing other classes. Since the laboratory may be used by other departments, convenience to the other areas of the school plant should be considered. Particular attention should also be given to the possible cooperative use of the other vocational agriculture facilities by other departments.

B. CLASSROOM AND RELATED AREAS

Many aspects of vocational agriculture classrooms are the same as classrooms for other subject areas. Detailed suggestions are given here for effective planning of classrooms, with drawings and photographs to help planners visualize plans. Figure 1 shows relationships of work and study areas in a larger laboratory, and Figure 2 in a smaller laboratory.

1. Classroom

   a. *Size and Arrangement:* The classroom should be located conveniently to the laboratory. This is necessary in order for the teacher to adequately supervise students who may be doing individual work in the classroom and laboratory the same class period.

      In schools where two or more classrooms are provided, one classroom should be slightly larger. Such a difference will provide space requirements for large and small classes. In determining the amount of classroom space, from 35 to 45 square feet of floor area should be provided per student. Consideration should also be given to display cases and cabinets in determining the size of the room. In schools where two small classrooms are provided, it may be advisable to consider an accordian type or other movable partition which will permit the use of both classrooms for large groups. The partition must be as nearly soundproof as possible to make this practical. Classrooms should be of such shape as to permit (a) satisfactory visual aids projection, (b) clear viewing of front instruction area, and (c) optimum arrangement of classroom facilities.

      In schools where only one classroom is provided, the minimum size should be 900 square feet. This will provide space for large adult farmer classes and for other community groups.

   b. *Entrances:* Corridors, internal organization of the agricultural department and its relation to other school facilities should determine the size and location of doors. Usually doors 3 feet in width are sufficient.

   c. *Floor:* Concrete floors are more satisfactory if covered with a material such as floor tile. The finish should provide a light reflection factor of 30 to 50 per cent.

   d. *Lighting and Windows:* The lighting system, both natural and artificial, should incorporate adequate controls for high brightness, and at the same time make the best use of natural light.

      A lighting specialist should be consulted before making decisions concerning the location of facilities for both natural and artificial lighting.

      Proper lighting should be used to (1) create a cheerful atmosphere, (2) conserve physical energy, (3) reduce unnecessary physical tensions, (4) contribute to safety, (5) aid those with subnormal vision, and (6) promote work productivity, thus contributing to better learning. Proper lighting is aided by light-colored walls, floors, ceilings, and furniture.

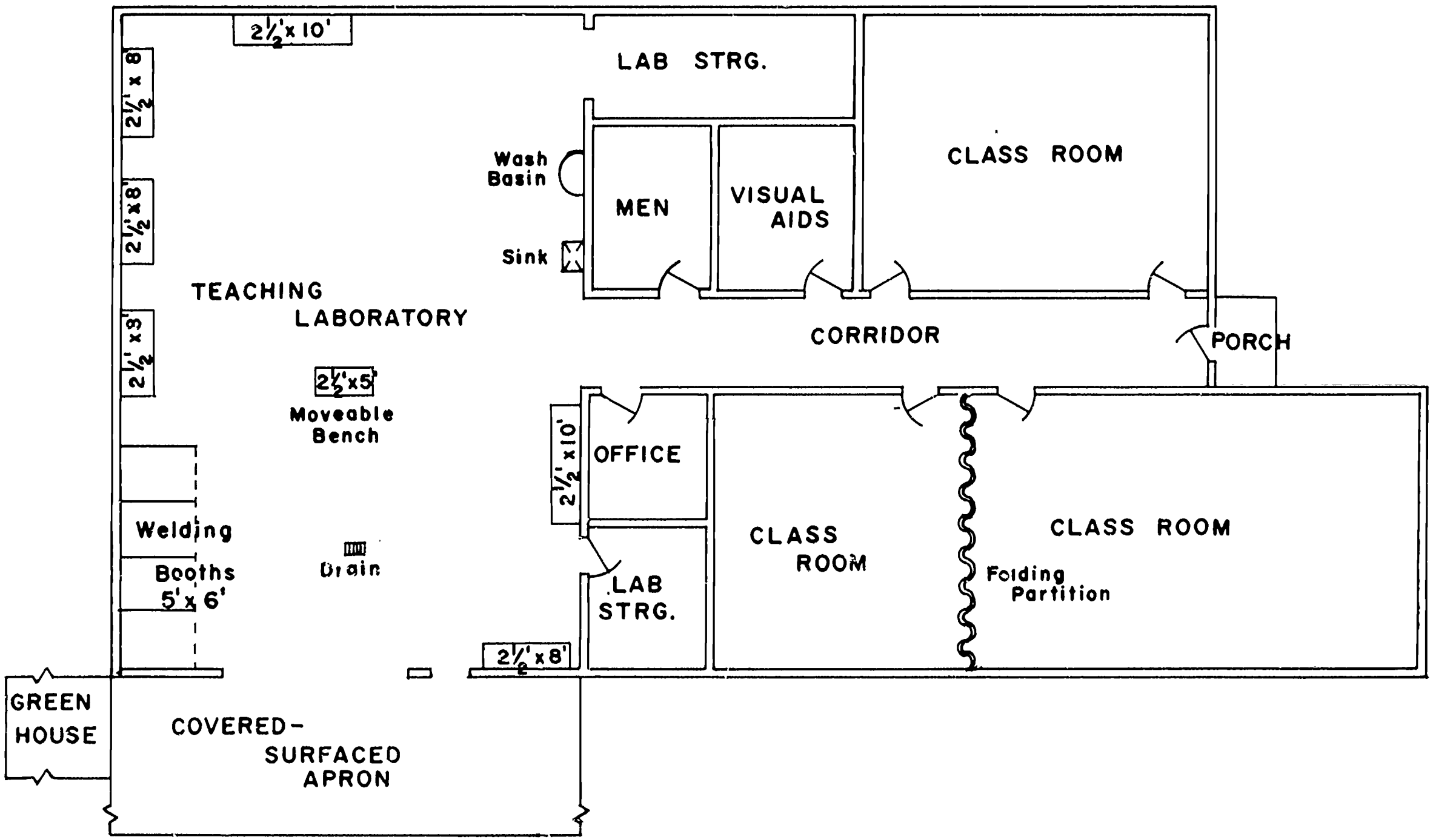

Figure 1

The diagram in Figure 1 shows the relationships of the physical areas of a multiple-teacher vocational agriculture department. A folding partition separating two of the classrooms may be opened for larger classes. The longer storage room takes long lumber and metal stock. Welding booths are convenient to the service door onto the covered and surfaced apron. The central area is free of obstructions to admit large farm machinery.

The diagram in Figure 2 shows similar relationships in a one-classroom department. Storage space for long lumber and metal is not shown, but this should be provided in the covered apron area. Storage for instructional materials for the classroom should be conveniently located, but not necessarily at the locations shown in the diagram. Welding booths again are convenient to the service door onto the apron. The central area again is free of obstructions to accommodate large farm machinery.

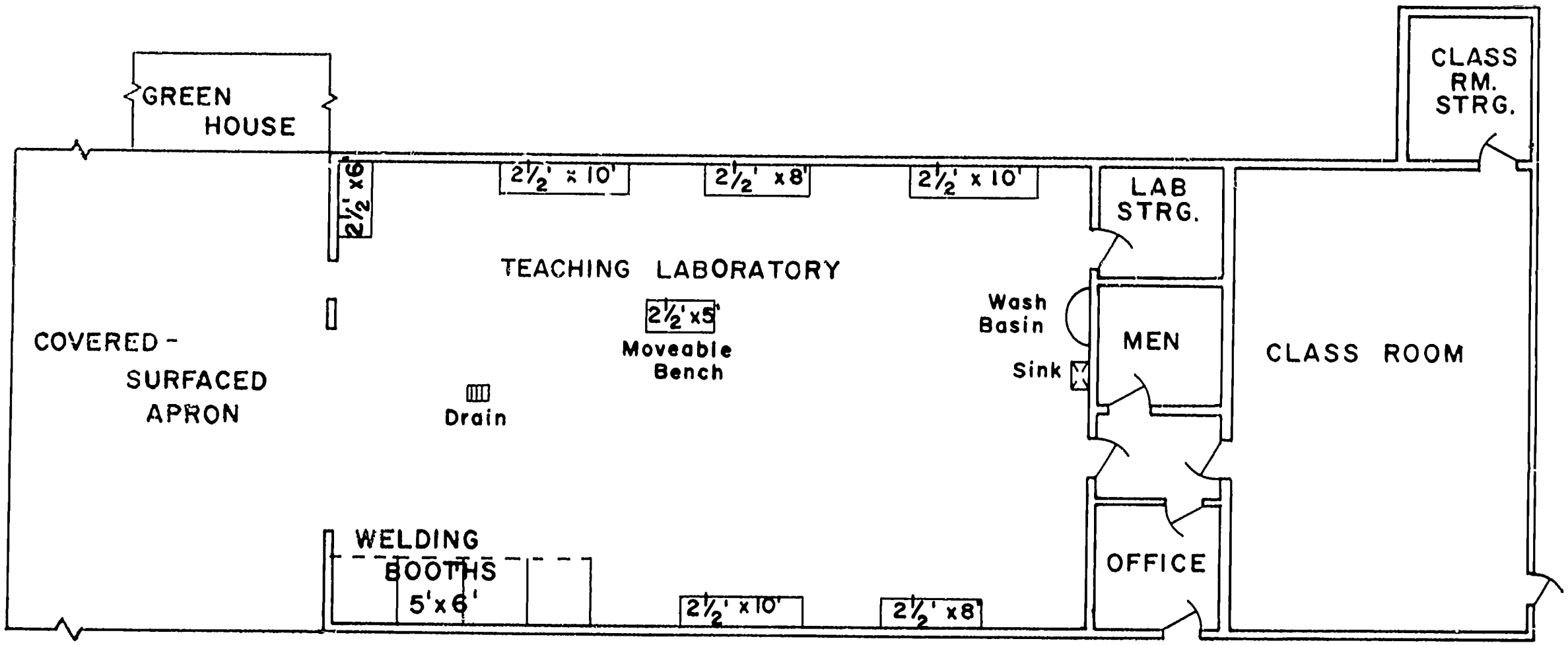

Figure 2. Relationship diagram with single classroom.

Light switches should be conveniently located with a sufficient number of single-pole, three-way or four-way switches to meet the essential needs.

It is usually advisable to locate windows along only one side of the room and in such a manner as to avoid direct sun glare. Windows should not be located in the front wall of the room (wall facing students when seated). Size and location of windows in relation to distance from floor and ceiling should be considered along with lighting the classroom in order that the windows will fit in the natural lighting features.

Windows should be of a type that provide needed draft-free ventilation and minimize air leakage.

In order to darken the room for projection purposes, the windows should be provided with blackout shades, curtains, or blinds.

e. *Heating and Ventilation:* Facilities to adequately heat both classroom and teaching laboratory should be provided. Since a considerable portion of the agricultural program is conducted beyond regular school hours (especially the adult farmer education program) consideration should be given to having a heating system which can be operated independently of the remainder of the school.

It is desirable to have controlled ventilation when the room is darkened for projection purposes and when the windows are closed. Any heating, ventilating or air-conditioning unit should operate quietly to avoid disturbance.

f. *Furniture:* The central area of the classroom should be kept free of all obstructions except movable furnishings. Care should be used in selecting furniture to assure the comfort and service essential to good instruction. The finish on the desks, tables and chairs should be non-glossy and blend with the color of the walls, floor, ceiling, display cases, and cabinets. Generally, light colored finishes blend well and aid in lighting.

If a demonstration table is not provided elsewhere, it is advisable to combine one with the instructor's desk. It should have an acid-proof top and be equiped with a sink, water, at least one electrical convenience outlet, and gas for heating. It should be located so that all students can clearly observe demonstrations, as shown in Figure 3.

To facilitate the use of drawing boards and instruments it will be well to consider a desk with an adjustable tilting top, Figure 4. If two-student tables are to be used, they should be from 24 to 30 inches wide and at least 60 inches long.

Nonfolding, lightweight chairs are usually more satisfactory than other types (Figure 4). The chairs should be of posture shape to assure maximum comfort.

g. *Electrical Outlets:* A sufficient number of conveniently located electrical outlets must be provided. In most cases 120-volt outlets are adequate.

Grounded plugs should be provided to facilitate use of electrical equipment that requires grounding.

h. *Miscellaneous:* Appropriate treatment should be given the ceiling and walls to provide suitable acoustical conditions. Ample chalk board and bulletin board space should be provided. Normally 20 to 25 lineal feet of chalk board and 6 to 10 lineal feet of bulletin board space is considered ample. The chalk board should be located so that it may be easily seen by all students and should have up to 20 per cent light reflection.

2. Conference Room-Office

The conference room-office should be conveniently located with glass panels that permit the teacher to have a clear view of the classroom and teaching laboratory. Sufficient space should be provided for the teacher's(s) desk(s), filing cabinets, record storage, and counseling with students. A minimum of 80 to 90 square feet will suffice in single-teacher departments, but a

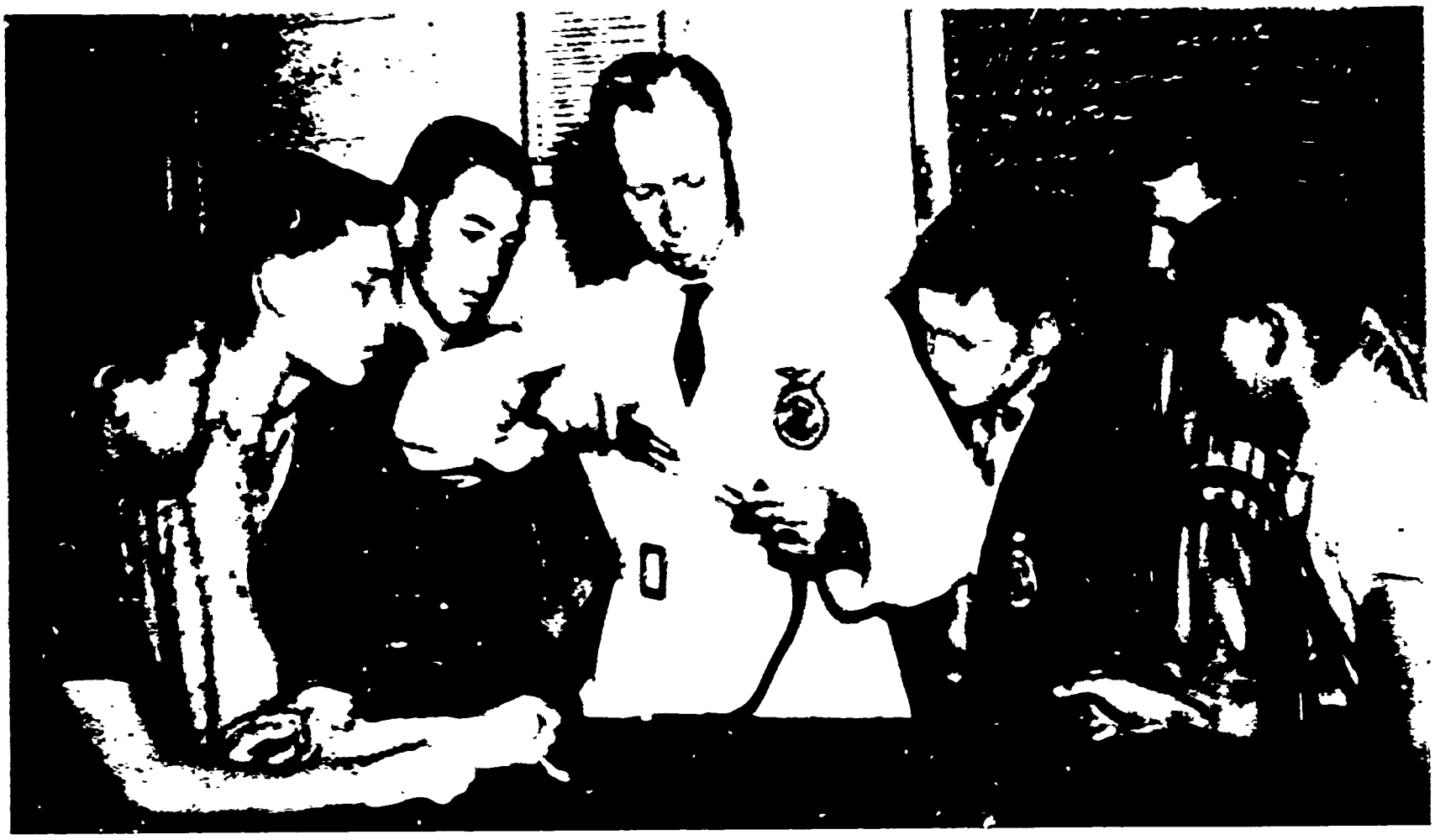

Figure 3. A laboratory desk in the classroom is very useful in conducting demonstrations.

Figure 4. In the classroom, an adjustable, tilting-top desk is desirable for each student. Non-folding, posture-type chairs are preferred.

minimum of 120 square feet should be provided for multiple-teacher departments. If the office is to serve as the library, consideration should be given to providing additional space and sufficient shelving and cabinets. Normally the finish and lighting in this room should be similar to the classroom.

3. Storage Room for Instructional Materials

A storage room, readily accessible to the classroom, should be provided for the storage of classroom audio-visual equipment and materials, books, bulletins, and other teaching aids and instructional supplies. This room; if so, this should be considered in dewide enough to allow for the construction of necessary shelves. In single-teacher departments at least 100 square feet of floor space should be provided. In multiple-teacher departments a minimum of 200 square feet is desirable. In single-teacher departments it may be advisable to store books and bulletins in built-in cabinets at the rear of the classroom instead of in the storage room; If so, this should be considered in determining the size of the classroom as well as in determining the size of the storage room, Figure 5.

In multiple-teacher departments the storage room should be located conveniently to each classroom so that it will not be necessary to go from one classroom through another to get to the storage room.

C. TEACHING LABORATORY AND RELATED AREAS

1. General Considerations

Needs of the future should be anticipated in planning the teaching laboratory. Under most conditions a minimum of 3200 square feet of actual laboratory space should be provided. Orientation of the building should favor prevailing summer winds for ventilation. Usually the service door should be located away from the direction of the main classroom buildings to minimize noise and other distractions.

2. Specific Features

a. *Area:* The increasing emphasis on mechanization demands a facility large enough to accommodate large farm machinery. To do this, provision must be made for large work areas, which are free of columns or posts and not obstructed by permanently-placed power tools, Figure 6.

b. *Width-to-Length Ratio:* A width-to-length ratio should not exceed 1½ to 2. A long narrow facility or one that is square is inconvenient and makes teaching and supervision difficult.

c. *Ceiling Height:* There should be a 14 foot clearance between floor and ceiling. This provides adequate height for entrance of farm machines.

d. *Floor:* The floor should be smooth, reinforced concrete, sloped one inch per hundred feet to a drain located near a service door.

e. *Service Door:* The service door should be conveniently located in relation to the service drive. Usually an end location is best. The door should be 14 to 16 feet wide and should open to a covered surfaced apron, Figure 7. A standard personnel door near the service door should be provided for foot traffic. It should measure 3 to 4 feet wide by 7 feet high.

f. *Surfaced Apron:* A paved apron of 1200 square feet is desirable for maintenance and study, temporary storage, and display of equipment. This area should be fenced with woven wire and equipped with a 16-foot gate. The area will be much more serviceable if it is covered. This facility will necessarily be located adjacent to and covering a large service door.

g. *Work Areas:* Specific areas should be assigned for class activities in farm machinery, buildings, electricity, irrigation, plumbing, and utilities. It is recommended that spaces for study and maintenance of farm machinery and welding be located near the large service door, Figure 8.

Figure 5. Supplementary display and storage space may be provided in the classroom.

Figure 6. A laboratory with an area free of posts and stationary equipment provides instructional space for large farm machinery.

h. *Materials Storage:* A separate room approximately 8 x 22 feet in size should be provided for lumber and metal storage. A combination of wall and floor racks or overhead storage should be included, Figure 9. Carts have been found desirable to supplement the permanent storage space. Special facilities should be provided for the safe storage of paints, fuels, and solvents.

i. *Tool Storage:* Cabinets, wall or bench mounted, should be provided to store tools in work areas, Figures 10 and 11. Special tools should be stored in the general storage room. Portable cabinets and tool carts may be used to supplement wall cabinets and general storage room facilities.

j. *Windows:* A sill height of 42 inches is recommended, with interior bottom frame sloped inward and down at 45 degrees. A sloped lower inside frame will help to prevent accumulation of dust and debris.

k. *Lighting:* For optimum lighting conditions 30 to 100 foot candles should be provided. Good lighting, natural or artificial, requires absence of glare and ease of maintenance.

l. *Color:*

(1) *Room Surfaces:* Each laboratory should be painted in accorddance with its exposure to natural light using colors to secure the maximum amount of glareless, reflected light. The following reflection factors should be considered:

(a) Walls should reflect 40 to 60 per cent of the light reaching them.

(b) Ceilings should reflect 70 to 90 per cent of the light reaching them.

(2) *Equipment:* Color coding should be according to current recommendations for safety standards.

m. *Ventilation:* For most conditions, natural ventilation is adequate. Artificial ventilation may be needed in some areas to remove fumes, gases and dust produced by engines or by work in progress. Welding and spray booths should be ventilated according to established industrial standards.

n. *Electrical Outlets:* Since most of the power tools will be portable, careful planning for location of power outlets is essential and should be in conjunction with workbench locations. Initial installations should be adequate, thereby eliminating the need for supplemental wiring.

Grounded, 120-volt convenience outlets should be placed at 10 to 12 feet intervals along the wall above the workbenches and adjacent to all work areas.

Power outlets for large motors, wired for ample voltage, should be spaced approximately 20 feet apart in work areas. Outlets should be provided near walls for permanently installed power tools. Provision should be made for at least one special power outlet for a welder in each welding booth.

At least one 120-volt convenience outlet and one welding outlet, both grounded, waterproof types, will be required on the wall outside the building near the service door. Additional outlets will be needed if the surfaced apron is covered.

One ceiling light should be controllable from every entrance. This will provide sufficient light for access to the distribution panel.

The electrical distribution panel should be of sufficient amperage for present and future needs.

o. *Workbenches:* Generally, 6 lineal feet of bench space per student is adequate; however, a total of 40 feet should be considered as minimum and 90 feet as maximum. A usual width is 24 inches; a height of 34 inches is average, but benches may range from 32 to 36 inches depending on "reach" of students. For metal working, benches should be equipped with metal tops.

A portable metal covered demonstration table (2 x 6 feet) with a storage

Figure 7. A service door adequate for large machinery should be flanked by a convenient personnel door.

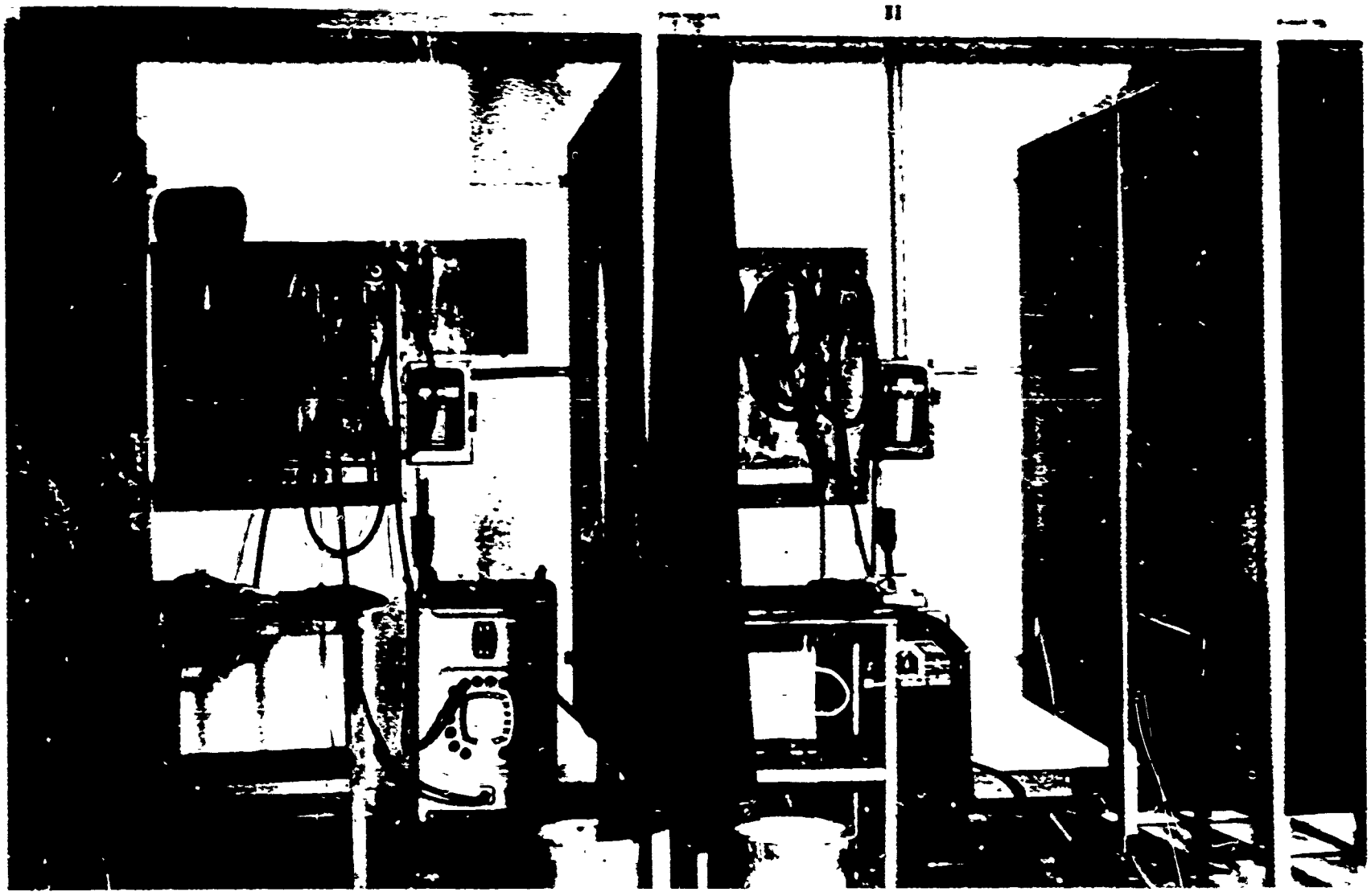

Figure 8. Welding booths adequately equipped are conveniently located just inside the service door. The welding sets may also be moved to electrical outlets just outside the service door under the apron shed.

shelf underneath is a convenient teaching device. Portability may be provided by 6-inch heavy-duty rubber-tread casters. Provisions should also be made for anchoring the table.

p. *Overhead Hoist:* A rail-mounted one-ton overhead hoist leading from the vicinity of the service door to the machinery work area may be provided. Overhead beams should be strengthened to furnish adequate support if this system is to be used. A portable A-frame, which may be on casters, is more flexible in use and is generally preferred over a fixed or semi-fixed hoist.

q. *Water Outlets:* A laboratory sink, 2 ft. x 2 ft. x 1 ft., made of heavy galvanized or stainless metal is desirable for general use. At least two additional water outlets, on which a hose may be used, will be needed; one should be near the welding area and another on the outside wall adjacent to the paved apron.

A circular, industrial type lavatory will permit clean-up by at least 6 students at the same time, Figure 12. A drinking fountain should be provided in the teaching laboratory.

r. *Chalk Board:* A portable chalk board (reverse side should be a tack board) 4 x 6 feet, is recommended.

s. *Movable Seats:* Seats, easily moved, are recommended for use by students while demonstrations are being conducted. The number of seats should be determined by the size of the largest class.

t. *First Aid:* A large first aid kit, fully supplied and clearly marked, is needed.

u. *Fire Extinguishers:* Fire extinguishers should be provided, and the size, number and type should be in accordance with current fire prevention codes.

D. GREENHOUSE

1. Needs and Uses

With strong emphasis being given to the area of plant science, much consideration should be given to including a greenhouse in the plans for a department of vocational agriculture, Figure 13. The extent of the instructional program and the expected student enrollment should determine the size and type of greenhouse to be constructed. Consideration should be given to the cooperative use of the greenhouse with the other departments of the school.

2. Specific Features

a. *Size:* Generally, a minimum of 300 square feet of floor space should be provided with a minimum width of 10 feet. This would be sufficient in width to provide for a 36-inch bench on each side and a 48-inch walk in the center. If the greenhouse is to be used by large classes, consideration should be given to providing larger areas by extending the length.

b. *Construction Materials:* The base and wall for a height of 3 to 4 feet may be constructed of masonry materials. The frame should be constructed of metal. Glass should be used for a permanent covering. Polyethylene makes a cheap and satisfactory covering, but is only temporary and must be replaced annually. Glass is much more expensive but is more nearly a permanent covering. Consideration should be given to suspending a fine mesh wire over the roof and sides to reduce breakage from thrown objects.

c. *Equipment:* For optimum use of the greenhouse it is necessary that heat be available at all times, including nights, weekends, and holidays. This may be provided by a self-contained electrical, steam, hot water, or hot air heating system. In cases where the greenhouse is conveniently located, the heating plant of the school may be connected to the greenhouse. Any heating system used should be automatically controlled by a thermostat in the greenhouse.

Automatic ventilation should also be provided. Such ventilation may be accomplished by automatic ridge ventilators or exhaust fans. It is advisable to

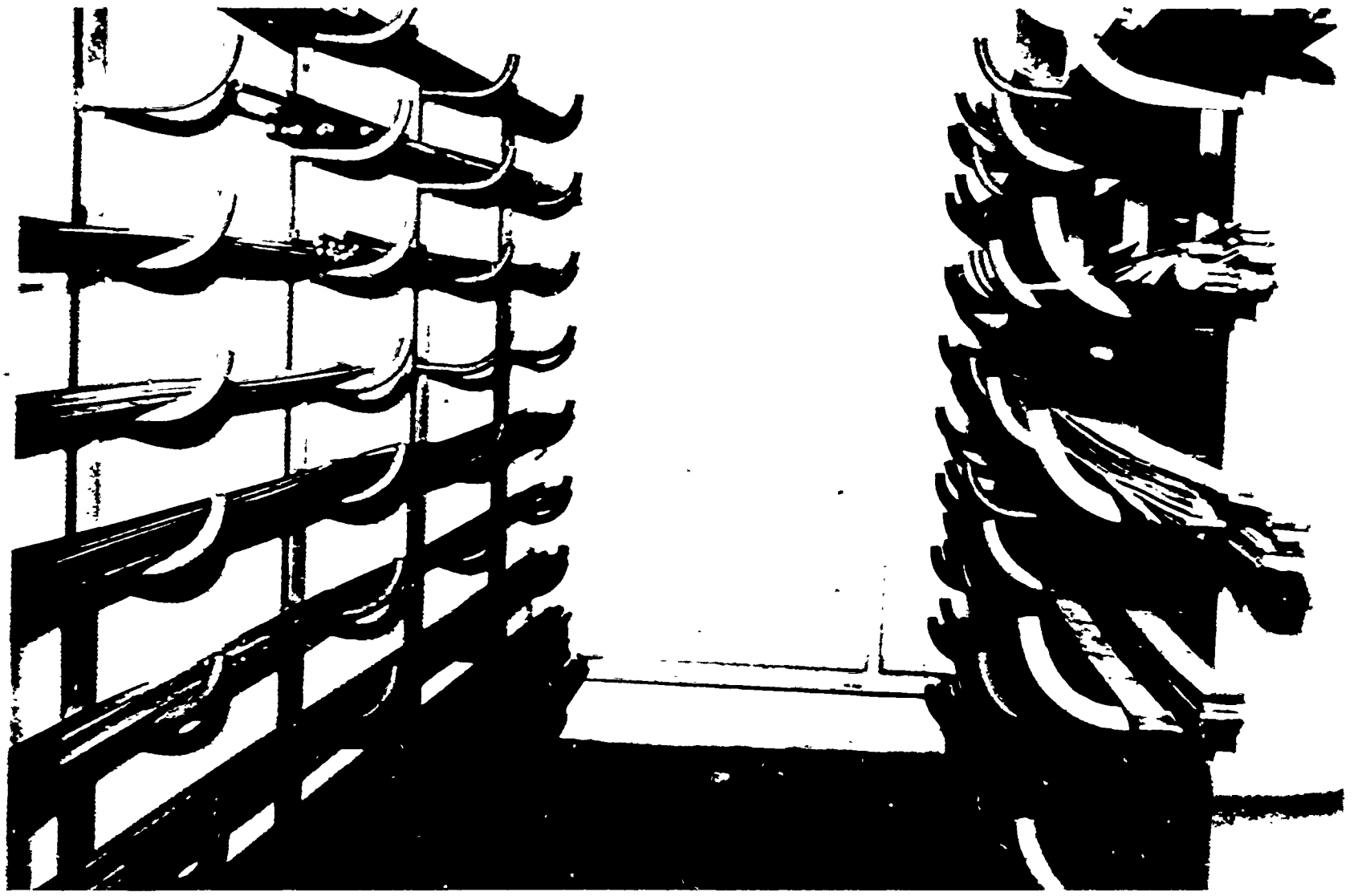

Figure 9. Metal racks constructed of curved pipe will hold flat and round stock for storage.

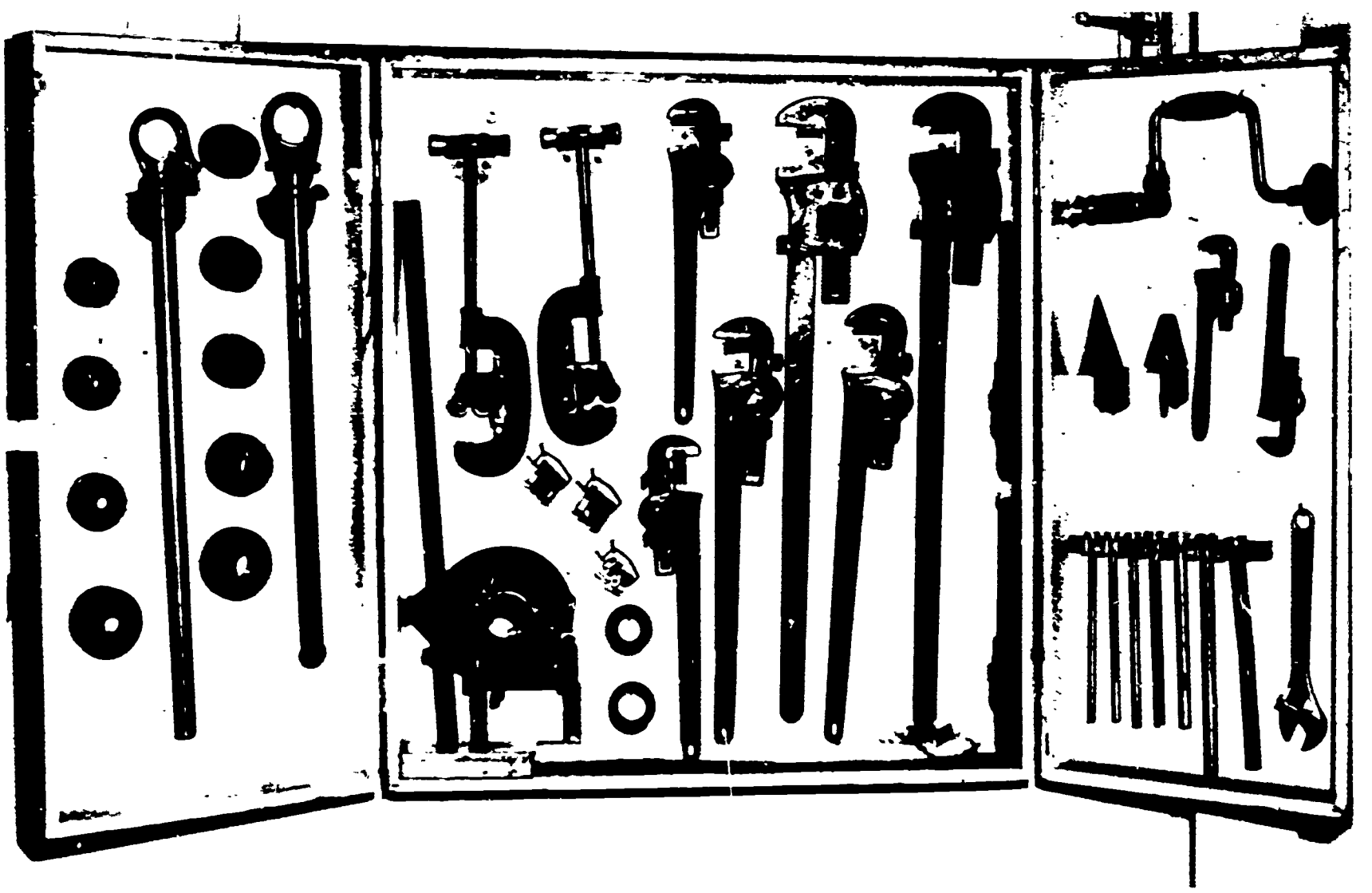

Figure 10. A wall-mounted tool cabinet is conveniently located near the workbench.

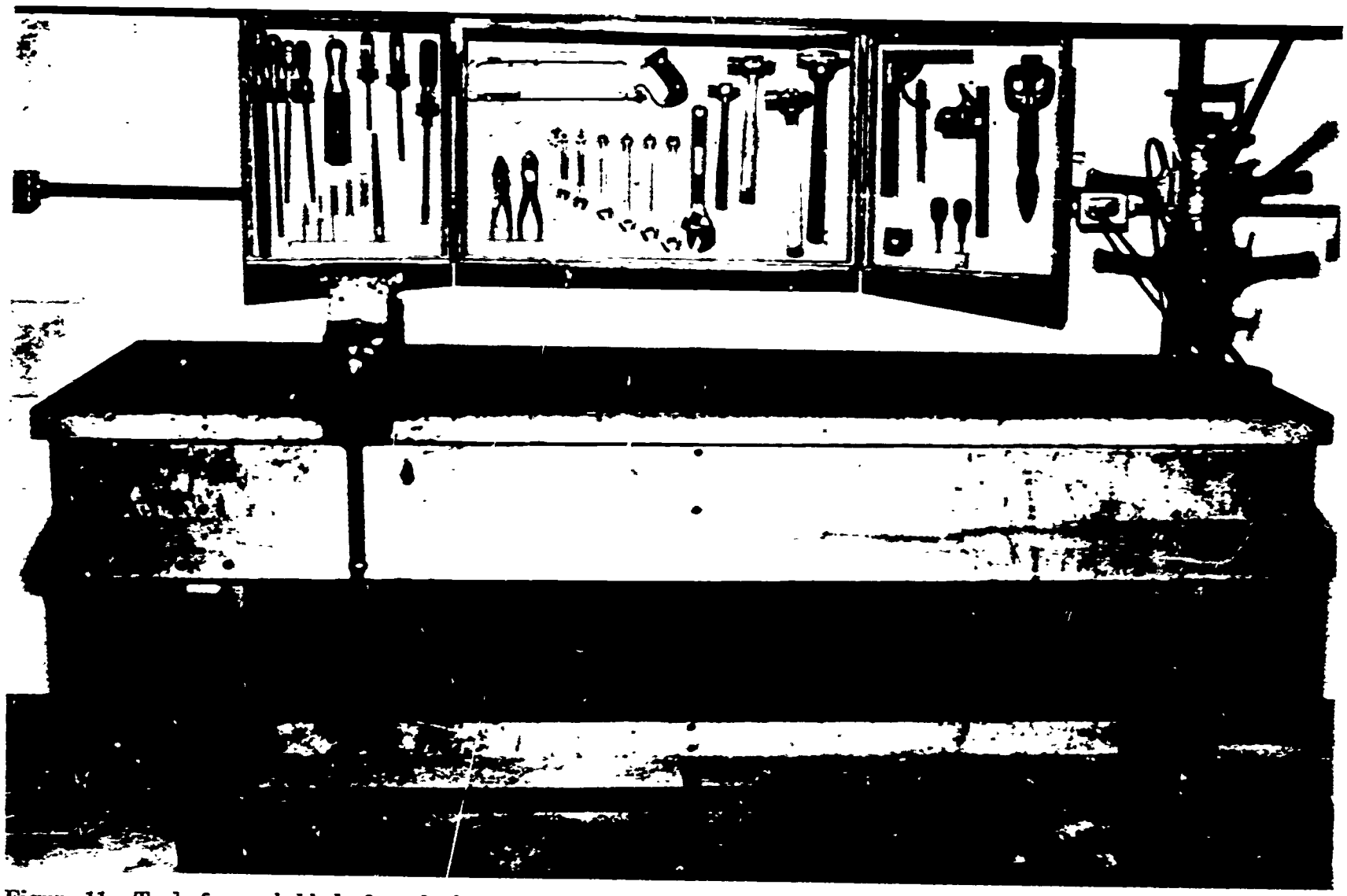

Figure 11. Tools for each kind of work should be stored in cabinets in the work area in which they are used most frequently.

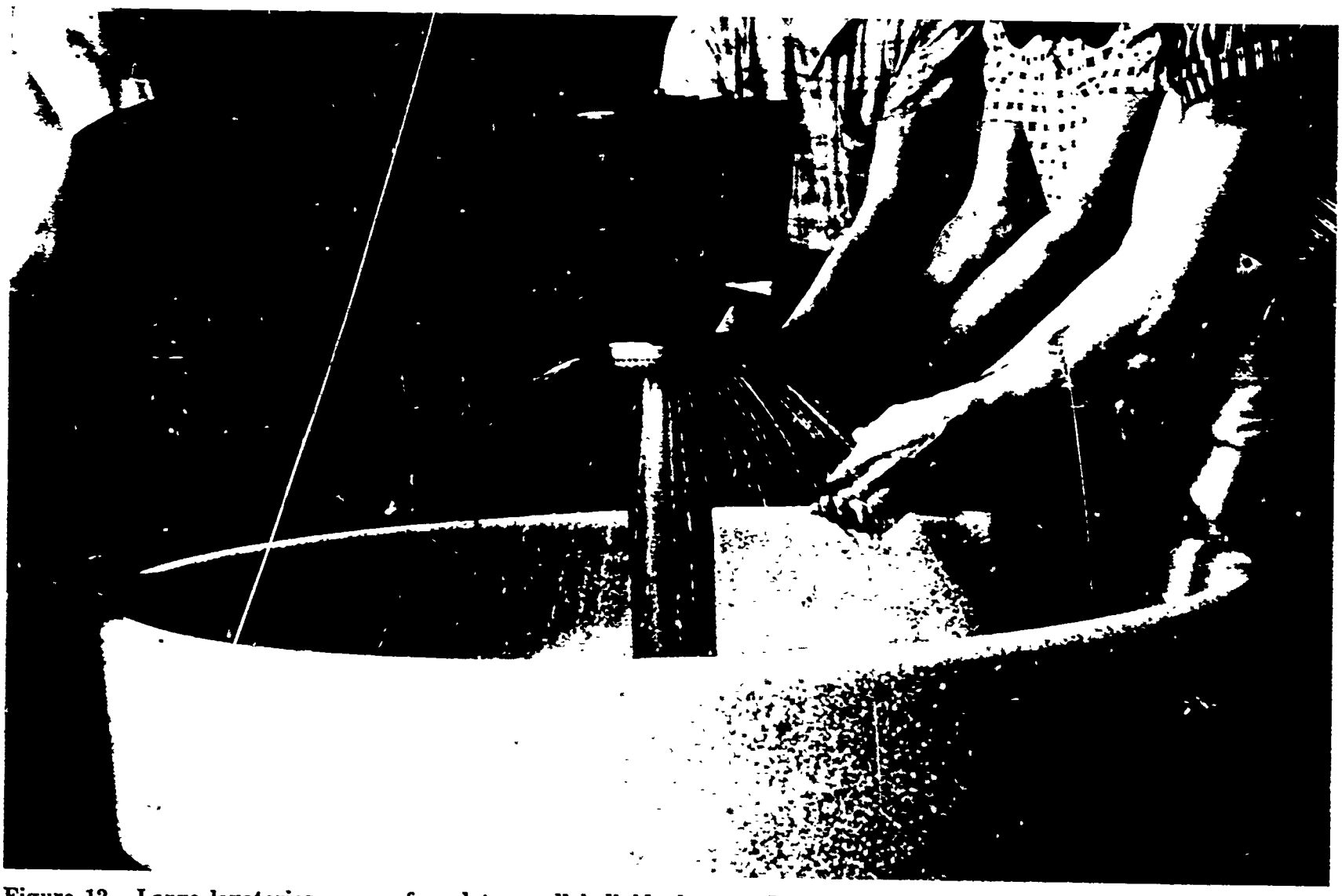

Figure 12. Large lavatories are preferred to small individual types. In some situations the half-round lavatory may be preferred over the round.

equip the greenhouse with a humidifier controlled by a humidistat. At least one water outlet, on which a hose may be used, should be provided.

Adequate illumination should be provided for night work. Convenience outlets should be provided to allow the use of additional equipment such as lamps for forced plant growth.

Benches approximately 36 inches wide and of convenient height, usually about 30 inches, should be provided along the walls inside the greenhouse.

The extent that the greenhouse is to be used as a laboratory should determine additional equipment to be provided.

III. SELECTING THE BASIC EQUIPMENT AND TOOLS FOR AGRICULTURAL MECHANICS IN VOCATIONAL AGRICULTURE

To provide instruction to meet the needs of students in the vocational agriculture program, adequate equipment and tools are necessary. Since the instructional program may vary from one school to another, a basic list of equipment and tools may have limitations. A number of factors may influence the kind of equipment and number of tools to be provided. Among these factors are: (a) type and extent of program being offered, (b) number of students, (c) available space, and (d) local budget. A list of basic equipment and tools is presented on the following pages. In some cases it may be necessary to add equipment and tools to the list. No attempt has been made to designate a definite number of any of the items of equipment or tools since this should be determined by the factors listed above. Specifications listed for tools and equipment should be considered as minimums. It is essential that standard equipment of good quality be purchased.

The equipment and tools listed are divided by the types of instruction in which they will be used most frequently. Items that may be used in several or all kinds of instruction are listed only once.

FARM ENGINES AND MACHINERY

Item	Description	Approximate Cost
Benches	**Homemade**—24" wide, various heights, 30" to 36".	
Blocks	**Repair**—12" x 3 7/8" x 3 1/8".	5.00
Brushes	**Wire**—7¼" x 2 7/8", curved back.	1.00
	Carbon removing—1" diameter, ¼" shank.	1.00
	Buffing—6", ½" center hole.	.75
Cans	**Gasoline**—5½ gallon military type.	4.25
	Gasoline—2½ gallon, 2½" hexagon filler cap, flexible spout.	2.25
	Radiator Filler—12 quarts.	3.00
Chains	**Log**—¼" x 14' and 5/16" x 14'.	13.00
Chisels	**Cold**—⅜", ½", ¾" and 1".	2.25
Clamps	"C"—Malleable iron, 6", 8" and 10".	13.00
Compressors	**Air**—(See Farm Buildings list).	
	Piston ring—1¾" to 3" capacity.	1.00
	Valve spring—⅞" capacity.	3.00
Cords	**Extension electrical**—25' No. 16 wire, 10 amp. capacity.	2.25
Creeper	**Mechanics**—36" x 16", 2½" wheels.	7.25

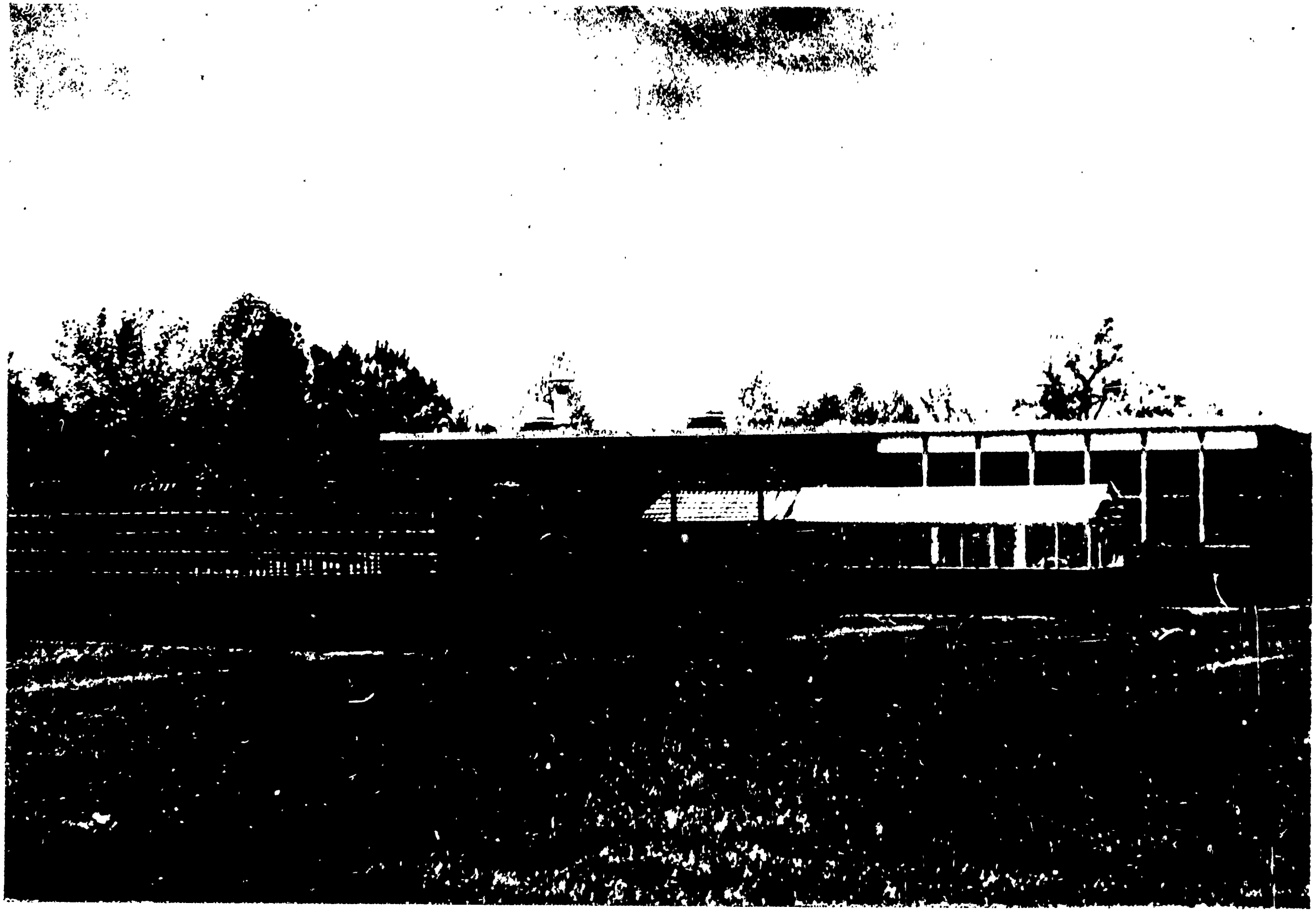

Figure 13. A greenhouse and slathouse conveniently located near the classroom.

Item	Description	Approximate Cost
Jacks	**Hydraulic**—1½ ton capacity.	72.75
Knife	**Putty**—1¼" wide, carbon steel, flexible blade.	.75
Letters	**Steel**—1 set ¼ inch letters.	15.75
	Steel—1 set ¼ inch figures.	5.25
Lights	**Trouble**—25' shockproof, 2 convenience outlets in handle with guard.	3.00
Oilers	**Measurer**—2 quart capacity.	2.00
	General purpose—4" straight spout, 10 ounce capacity.	.25
	Pump—7/8 pint capacity, 7" spout.	.50
	Trigger—6 ounce, 6" spout, forced fed.	1.25
Pans	**Drain and clean**—12" x 14" x 14" flared sides and ends. Homemade.	
Pliers	**Slip joint**—7½" side cutting, 2 adjustments.	2.50
	Arc joint—9½", 5 adjustments, chrome plated.	2.75
	Diagonal cutting—7" long, wide jaw, heavy duty.	3.00
	Lineman's—8½" long, heavy duty, beveled nose, side cutting.	4.00
	Long chain nose—6", half round jaws, honed side cutters.	3.00
	Battery—7½", 40° angle head.	1.50
	Ignition—5¾", 40° angle jaws, capacity 0 to 5/8".	1.25
Punches	**Center**—3/8" x 4½" and ½" x 6".	1.25
	Pin—3/32" x 4¼", 5/32" x 4 7/8", ¼" x 5 5/8" and 5/16" x 6".	3.50
	Line up—3/16" point, ½" stock, 9" long; ¼" point, 5/8" stock, 10" long; 3/8" point, ¾" stock, 12" long; forged steel.	3.75
	Solid—¼" point, ½" stock, 6" long; 5/16" point, 5/8" stock, 7" long; 7/16" point, ¾" stock, 7" long.	4.00
Pullers	**Gear**—Auto-grip, jaw spread 0 to 6" and 0 to 8".	13.00
Reamers	**Burring**—Capacity ¼" to 1 ¼".	2.25
Refacers	**Cylinder ridge**—2" to 3" capacity, self centering body.	8.50
	Valve—For small gasoline engines.	3.50
	Valve seat—45% angle.	2.00
Saws	**Hack**—Adjustable frame, 8", 10", 12" blades, 3¼" depth, spade grip handle	3.25
	Hack—Shallow throat.	2.00
	Power Hack—Capacity 6" x 6" complete with ½ H.P. 110-220 volts, single or 3 phase 60 cycle, replusion-induction type motor and motor controls.	410.00
Screwdrivers	**Standard bit**—3/16" x 4", ¼" x 4", ¼" x 6", 5/16" x 8" and 3/8" x 12", mechanics heavy duty, plastic handles.	6.00
	Phillips—4", 6", and 8", milled flutes, plastic handles	$ 3.25
	Stub—1¼" blade, 3¼" long, plastic handle	.75
	Offset—Standard bit, forged steel.	.75
Seamer	**Handy**—7/8" x 2½".	5.50
Scales	**Platform**—18" x 27" graduated in ½ pound, 1000 pounds capacity.	89.00
Sets	**Rivet**—No. 6 and 8.	3.25

Item	Description	Approximate Cost
Cutters	Bolt—24", capacity in soft metal 3/8", beveled cutters.	8.25
	Pipe—1/4" to 2" capacity.	12.00
	End Nippers—10" long, tempered steel jaws.	2.50
	End Nippers—12", replaceable jaws.	7.00
Dies	Pipe—Ratchet type 1/4" to 1 1/4" capacity.	39.50
Drills	1/4" Electric—Capacity 1/4" in steel, 3/4" in wood, D.C. or A.C., 60 cycles.	46.00
	1/2" Heavy duty—Capacity in steel 1/2", capacity in wood 1 1/2".	$112.00
	Stand—	70.00
Expanders	Piston ring—Capacity 1 1/4" to 2 1/4".	1.50
	Flaring tool set—3/16" to 5/8" flaring tool, 1/8" to 1" cutter, and 1/4" to 5/8" tube bender.	8.75
Files	Ignition points—5" double cut.	.25
	Slim taper—6", 8".	1.00
	Mill—8" and 10", bastard cut.	1.00
	Flat—8", 10" and 12", bastard cut and 2nd cut.	4.75
Funnels	Utility—8" and 6" diameter.	1.75
Guages	Spark plug—8 wire gauges, and electrode wrench.	1.50
	Thickness (feeler)—26 leaf, 3 1/16" spring steel blades .0015 to .025 inch thick.	3.75
	Calipers—Inside and outside spring nut, 10" in length.	4.00
	Compression—Offset stem, 0 to 300 lbs.	13.00
	Vacuum—3 1/2" dial, 0 to 30 inches vacuum, 0 to 7 pounds pressure. Rubber adapter, 1/8" pipe fitting, with 1/8" to 3/8" reducer bushing.	6.00
	Tire—Pencil clip type, chrome plated—reads 5 to 50 pounds (low pressure or water tires).	1.25
Gloves	Welders—Cowhide, 5 finger.	2.00
Goggles	Welders—Adjustable, shade 5 lens.	2.00
	Grinding—Adjustable, clear plastic.	2.00
Grinder	Valve—Hand operated, interchangeable cups.	2.75
	Tool fitting—General purpose complete with switch, guards, grinding wheels, and 1/3 H.P. 110 volt single phase motor, cord and plug.	60.00
Grinder cont.	Heavy duty—Single or 3 phase 10" x 1" wheels, 1 H.P. motor.	165.00
Guns	Grease—Hand, 3 way loading, 20 ounce capacity.	3.75
Hammers	Ball pein—8 ounce, 12 ounce, 16 ounce, and 24 ounce, forged steel head, hickory handles.	7.50
	Blacksmiths—32 ounces heat treated head, hickory handles.	4.50
	Plastic tip—16 ounces, one tip vinyl, one tip plastic, hardwood handle.	2.75
	Rubber—24 ounces, steel core, rubber tips.	2.00
	Engineers—48 ounces, cross pein.	5.00
Hoist	Portable chain—2 ton capacity, spur geared, 12' lift. Homemade portable frame with steel casters.	263.00
Indicators	Speed—2 rubber tips.	6.25
Iron	Soldering—200 watt, heavy duty, 5/8" replaceable copper tip	7.00

Item	Description	Approximate Cost
Shafts	Flexible—72", 1/2" steel wire core, fits 1/2" and 5/8" motor shaft, 1/3 H.P. motor and stand.	75.00
Ships	Tinners—Straight bill, 10", 2 3/4" cut.	2.50
Spouts	Can-tapper and pour-spout—curved.	.75
Stones	Sharpening—Combination, coarse and fine, 7" x 2" x 1".	1.50
Taps & Dies	Combination screw plate—59 piece auto mechanics set, 23 cuts, 1/4" to 3/4" N.C.; 1/4" to 3/4" N. F.; 5 machine screw sizes; 1/8" and 1/4" pipe; thread gauge and screw extractors, No. 1-5	53.00
Tester	Tune-up—Meter type. To include the following components: (1) Timing light (3) Dwell, tach tester (2) Amps, volts, regulator tester (4) Meter ignition tester (5) Mobile floor stand	197.00
	Battery Cell—Adjustable legs, 6 and 12 volt.	7.00
	Battery Hydrometer—Sealed temperature correction chart, no-stick float, 0° to 160°.	1.50
	Antifreeze—4 cunce bulb, 8 1/2" tube, ball type float, with temperature correction.	2.75
Tongs	Blacksmith—Straight lip, 24" long.	5.00
Torches	Propane—With pencil flame burner.	5.50
Vise	Machinist—4 1/2" jaw, opens to 7". Malleable cast iron with replaceable steel jaws.	40.00
	Pipe—Hinged, capacity 1/8" to 2 1/2".	16.75
	Drill—4" jaw opening.	20.00
Welders	Electric Arc:—Capacity, 20 to 180 amps; 20% duty cycle, 230 volt, single phase, 60 cycle, rated load 37 amps, complete with 300 amp electrode holder, 300 amp ground clamp, electrode cable, ground cable, and input cable with molded rubber plug.	94.00
	Arc torch—Adjustable carbon rod holders.	8.00
	Oxy-acetylene welding and cutting—Oxeygen regulator, acetylene regulator, 35' of 3/8" twin hose, welding torch, cutting torch, No. 1, 2, 4, 6, and 8 welding tips, No. 1 and 2 cutting tips, wrench and tip cleaners.	130.00
	Helmets—Light weight with changeable lens for electric welding.	6.00
	Hand shields—Light weight with changeable lens for electric welding.	5.00
Wrenches	Rim—4 way, 22" arms, 5/8" diameter, fits 3/4", 13/16", 7/8" and 15/16" hexagon nuts.	2.75
	Ignition—8 piece, combination midget 13/64 x 7/32 to 3/8 x 7/16.	4.25
	Torque—1/2" square drive, 0 to 105 ft. lbs.	9.50
	Obstruction box—7/16" x 1/2", 9/16" x 5/8".	4.00
	Universal joint—1/2" square drive.	2.00
	Ratchet—1/2" square drive, 9 3/4" long.	6.00
	Ratchet—3/8" square drive, 6 3/4" long.	4.50
	Flex handle—3/8" square drive, 10" long with crossbar.	
	Speeder—3/8" square drive, 16" long.	2.00
	Speeder—1/2" square drive, 18" long.	3.00
	Extension bars—3" and 10".	2.00

Item	Description	Approximate Cost
	Universal joint—3 8" square drive.	2.00
	Locking plier—7½" and 10".	4.25
	Pipe—Heavy duty, 10", 14", 18".	13.00
	Set screw—Set of 10, 1 16" to 5 16".	1.25
	Adjustable—8" - 7 8" capacity.	2.00
	Adjustable—12" - 1 5 16" capacity.	3.75
	Open end—6 piece set, 3 8" x 7 16", ½" x 9 16", 19 32" x 11 16", 5 8" x ¾", ¾" x 7 8", 15 16" x 1".	5.75
	Box end—6 piece set, 3 8" x 7 16", ½" x 9 16", 9 16" x ⅝", 11 16" x 13 16", ¾" x 7 8", 15 16" x 1".	6.00
	Socket—3 16" to ½", ¼" square drive.	8.50
	Sockets—3/8" square drive, 12 point opening, ¼", 5 16", 3 8", 7 16", ½", 9 16", ⅝", 11 16", ¾".	5.00
	Sockets—½" square drive, 12 point openings, 7 16", ½", 9 16", ⅝", 11 16", ¾", 13 16", 7 8", 15 16", 1", 1 1 16", 1 1 8", 1¼".	10.50
	Sockets—½" square drive, spark plug holding 13 16", 7 8".	2.50
	Flex handle—½" square drive, 15" long with crossbar.	3.50
	Extension bars—½" square drive 3" and 10".	2.25

RURAL ELECTRIFICATION

Ammeter	AC, 6" rectangular face, 40 scale divisions, 20 amp.	90.00
Bender	Conduit—½" to ¾".	7.50
Cutter & Crimpers	Wire combination tool to cut and strip wire and crimp solderless connectors.	4.75
Guage	Wire.	5.50
Knife	Linoleum—2½" blade.	1.75
Meters	Kilowatthour meter—Single phase, 15-ampere, 2-wire, 120 volt, 60 cycle, either bottom-connected or socket mounted.	65.00
Puller	Fuse—Fiber or plastic, for fuses up to 200 amps.	1.00
Screwdrivers	Electricians'—3", 6", 10" small blade, plastic handle.	.25
Stripper	Cable—Non-metallic sheath, Nos. 6-14 wire.	6.00
Tester	Circuit—230 volts, neon tube.	3.00
Voltmeter	A.C.—Self-contained, 150 volts, 30 scale divisions.	97.00
Wattmeter	240 volts—Self contained, 0.1 to 20 amp., 6" face.	177.00
Meter register	Cyclometer type	7.50
	Pointer type	7.50

Supplies for Demonstration Panel*

Wire	30 feet insulated No. 14, black, stranded	1.50
	6 feet insulated No. 14, white, stranded	.25
	100 feet rubber covered solid conductor, No. 12 black.	5.00
	100 feet rubber covered solid conductor, No. 12 white.	5.00
	2 feet nichrome, No. 19.	.25

*Assembly Instructions available from:
Office of Coordinator
Department of Agricultural Engineering
University of Georgia, Athens, Georgia

Item	Description	Approximate Cost
Lamp cord	110 feet twisted, No. 18.	6.00
Cord	15 feet rubber covered, No. 16.	3.00
Receptacles	8 porcelain cleat.	3.25
Switches	2 single pole, knife, 25 ampere, 125 volts.	1.00
	1 double pole, momentary-contact, toggle.	5.00
Studs	20 Nu-Way	1.50
Terminals	52 Nu-Way	6.50
Switch box	Rectangular, bakelike with cable clamps.	.50
Switch cover	Toggle, bakelite, for above.	.25
Plugs	4 screw-in.	1.00
	1 attachment, rubber.	.25
Fuses	10 plug-type, 6 ampere.	1.25
	3 plug-type, 15 ampere.	.50
Masonite	1 sheet 3 16", 28¾" x 48".	2.00
Strips	4 wood ¾" x 1¾" x 6".	.25
	1 wood ¾" x 3¾" x 71½".	.25
Bolts	6-1½" x 1" flat head stove.	.25
	20-3 16" x 1" flat head stove.	.75

SOIL AND WATER CONSERVATION

Auger	Soil—2" diameter, 40" long.	6.00
Hatchet	Half—Blade 4½".	4.75
Level	Hand—5".	2.50
	Surveying—Telescope with magnifying power of 16 to 18 diameters with tripod and compass.	105.00
Planimeter	Surveyors—4 1 8" tracer arm and 7½" pole arm.	38.00
Rod & Target	Surveyors—9' long graduated in feet and hundredths.	12.00
Tape	Steel—4 chains, graduated in links.	16.00
Taping pins	Heavy wire, set of 11 (may be made in shop).	4.75
Tube	Soil—21 inches.	4.75

FARM BUILDINGS AND CONVENIENCES

Ax	Single Bit—3½ pounds.	4.00
Bars	Clamp—3' and 5' opening.	9.00
	Wrecking—Goose neck, ¾" x 30".	2.50
Benches	Work—Wooden, 24" wide, 30" to 34" high. Shopmade.	
	Saw—2' high, 3' long, open top. Shopmade.	
Bevels	Sliding T—10" blade, 6 1 8" iron handle.	2.75
Bits	Auger—No. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16.	9.50
	Extension—18".	2.50
	Expansive—7 8" to 3" with two cutters.	3.00
	Screwdriver—¼", 5 16", 3 8" and ½" with bit stock shank	2.50

Item	Description	Approximate Cost
Boards	**Drawing**—20" x 30".	5.00
	Mortar—Wooden, 2' x 2'. Shopmade.	
Boxes	**Mortar**—Steel, 34 1/2" x 61", 21 cubic feet capacity.	24.25
	Miter—Wooden, 2 1/2" deep, 6" wide, 20" long (inside measure). Shopmade.	
Braces	**Ratchet**—Carpenters, 10" sweep, self centering chuck.	11.25
Brushes	**Duster**—8" with 2 1 8" bristles.	1.00
	Paint—4" Nylon.	3.25
	Sash—2" all pure bristles.	.75
Cabinets	**Tool**—36" x 36" x 7", double doors 1 1/2" deep inside. Shopmade.	
Cards	**File**—1 1/2" face, 9 1/2" long.	1.00
Chisels	**Brick Layers**—4" polished bit, 5/8" beveled square shank.	1.25
	Pocket—Blade length 4 1/2" widths 1/4", 3/8", 1/2", 3/4", 1" and 1 1/2".	8.00
	Wood—3 8", 1/2", 3/4" and 1" blade.	
Compass	**Drawing**—6".	3.25
Compressor	**Air**—Mounted, 3/4 H.P. single or 3 phase capacitor motor, displacement 4.8 C.F.M., operating pressure 150 pounds, tank capacity 30 gallons, single stage with automatic start and stop operation.	380.00
	Accessories—	
	(1) Oil and water extractor with regular, guage and mounting bracket.	
	(2) Spray gun with nozzel and siphon cup.	
	(3) 2-25' sections air hose.	
	(4) Air gun.	
	(5) Snap-on speed coupler fittings.	
Countersinks	**Bit Stock**—3/4" cutting edge, for use in 2 jaw chuck for wood or soft metal.	.75
Diggers	**Post hole**—capacity 6" and over, 4' handles.	4.75
Dividers	**Wing**—8" with adjusting screw and tension spring, clamp for pencil.	3.50
Dressers	**Grinding wheel**—with extra cutters.	1.00
Drills	**Hand**—Heavy duty, 1/4" capacity, 31 2" speed gear.	8.00
	Masonry—1/2" shank, carbide tip. Sizes—1/4", 3 8" and 1/2".	5.00
Drills cont.	**Star**—12" long. Sizes—1/4", 3 8", 1/2", and 3/4".	2.50
Edgers	**Cement**—2 7 8" x 6" curved blade.	.75
Files	**Augerbit**—7".	.75
	Crosscut—8" and 10".	2.00
	Mill—8" and 10" bastard.	1.25
	Wood—Flat, 10".	1.00
Floats	**Cement**—Aluminum, 5" x 13" blade.	1.25
	Cement—Wood, 4" x 2'. Shopmade.	
Furnaces	**Plumbers**—Gasoline, 1 gallon capacity.	23.75
Groovers	**Cement**—2 7 8" x 6 1 8" blade.	.75
Guns	**Caulking**—9" frame.	1.75

Item	Description	Approximate Cost
Hatchets	**Half**—3½" blade.	2.50
Hammers	**Brick Layers**—24 ounce head, 8¼" long.	3.00
	Nail—13 ounces, 16 ounces, and 20 ounces flat face, curved claw, tubular steel handle.	14.00
	Ripping—16 ounces flat face, straight claw, tubular steel handle	4.75
Hoes	**Mortar**—6" x 10" blade, 2 holes.	3.50
Irons	**Caulking**—Straight type, ½" x 7" stock.	1.25
	Yarning—4" offset bit, ½" x 8" stock	1.25
Jointers	**Bricklayers**—Flat and curved, 9" long.	2.50
	Surface & Edge—8" with 64" bed, complete with fence, guards, enclosed stand, cutterhead pulley, knives, 1 H.P. 3450 RPM single or 3 phase enclosed motor, with switch sheave and belts.	430.00
Ladders	**Extension**—Wooden, 32'.	29.75
	Step—Wooden, 6'.	8.00
Ladles	**Melting and Pouring**—Cast iron 10" long, capacity 1½ pound lead.	.75
Levels	**Carpenters**—24" aluminum, six glasses; 2 double plumb and one double level.	7.50
	Carpenters & Masons—48" aluminum, 2 level vials, 4 plumb vials.	13.00
Lines	**Chalk**—Aluminum alloy case and reel, self chalking.	1.00
Mallets	**Wooden**—3" face, 6" dogwood head, hardwood handle.	1.00
Mattocks	**Garden**—2½ pounds, 13" drop forged steel head, 2¼" cutter, 2⅝" hoe, 36" handle.	3.25
Picks	**Railroad**—6 pounds, 23" pick point, 36" handle.	4.00
Pincers	**Carpenters**—8".	1.25
Planes	**Block**—6" long, 1 3 8" cutter, blade at 12°.	5.25
	Jack—14" long, 2" cutter.	10.50
Plumbs	**Bob**—12 ounces, 5" long, solid brass with replaceable steel point.	2.00
Pots	**Melting**—Cast iron, bail handle, 4¾" top diameter, capacity 12 pounds molten metal.	1.25
Protractors	**Drawing**—6".	1.00
Rasp	**Cabinet**—10" and 12" half round bastard.	3.50
Rules	**Bench**—2', maple with brass tips, 1 8" and 1 16" graduations.	1.75
	Folding—(zig zag) 6', inside-outside reading with 6" extension bar for inside measuring.	2.50
	Push-Pull—8' power return, 1 32" graduations.	1.50
Runners	**Joint**—Asbestos, ¾" diameter, capacity 2" - 6" pipe.	2.00
Saws	**Back**—13 point, 16", 3¾ width vader back.	4.75
	Hand crosscut—8 point, 26" straight back, light weight.	6.00
Saws cont.	**Hand crosscut**—10 point, 26" straight back, light weight.	6.00
	Hand crosscut—9 point, 20" straight back.	5.75
	Hand Rip—5½ point, 26" straight back, light weight.	6.00
	Nest of—Interchangeable blades, 10" keyhole blade,	

	14" nail cutting blade, 14" compass blade and handle.	3.25
	Portable Electric—7", capacity 2" x 4" at 45 degrees, A.C.-D.C. motor.	56.00
	Tilting Arbor—12" complete with 5 H.P. 220 volt 3 phase motor, auto set miter guage, rip fence, guide rails, blade guard, splitter with anti-kick back fingers, 12" combination blade, 4 matched V-belts, motor pulley, and magnetic starter.	1000.00
Scales	Architects—12".	1.25
Screws	Hand—6" and 10".	6.25
Sets	Nail—2 32", 3 32", 4 32", and 5 32" square head, 3 7 8" long, 11 32" stock.	1.00
Shovels	Round Blade—8½" x 11½", 47" handle.	3.75
	Square Blade—9¾" x 12", 27" handle.	3.75
	Square Blade—7" x 12", 27" handle.	4.75
Splicer	Wire—5" long, 1" wide.	.50
Stretchers	Wire—Complete with chain ratchet handle for woven wire, 50" fence capacity.	31.00
	Wire—One man, 36" swivel handle for barbed wire.	3.50
Squares	Combination—12" grooved blade, graduated in 8ths, 16ths, and 32nds inch, 4½" handle.	2.25
	Framing—Steel, 24" x 2" body, 16" x 1½" tongue, 1 16, 1 12, 1 8 graduations, and 100th scale.	3.00
	T—30", black hardwood head, maple blade with transparent amber-lined edge.	3.50
Tapes	Steel—100', nickel plated black markings, marked in feet, inches, and eights.	10.00
Triangles	45 Degree—8", clear plastic.	1.00
	Lettering—8".	1.75
Trowels	Brick—Steel blade, 4¾" x 11".	3.00
	Cement Finishing—Steel blade, 4" x 14".	3.75
	Pointing—Steel blade, 2¾" x 5½".	1.00
Vises	Woodworking—4" x 10" continuous screw.	16.25
Wheel-barrows	Contractors—5 cubic feet capacity, 4 ply 4.00 x 8" tire, 16 guage steel tray.	25.75

AUDIO - VISUAL EQUIPMENT

Projectors	Filmstrip—slide—for 2" x 2" frames; 750 watts.	67.00
	Motion picture—16 MM sound—750 watts	469.00
	Overhead—1000 watts, with forced draft centrifugal blower, 115 volts AC, with minimum of 4" lens.	210.00
Screen	Daylight—50" x 50" on tripod.	25.50
Easel	Folding—All metal adjustable, 6 feet in height, sufficient to hold material up to 3' x 5'.	16.75

IV. SELECTING THE BASIC SUPPLIES AND TEACHING AIDS FOR AGRICULTURAL MECHANICS IN VOCATIONAL AGRICULTURE

Adequate instructional supplies and teaching aids are essential for an effective program in agricultural mechanics. Many supplies and teaching aids would not be common to all departments, therefore, a recommended list is omitted in this publication. They should be determined by several factors including (a) type and extent of the program to be offered, (b) method of teaching to be used by the instructor, and (c) teaching facilities available.

An up-to-date list of sources of teaching aids may be secured from the Vocational Materials Laboratory, State Department of Public Instruction, Raleigh, North Carolina.